

Pavement Preservation
Checklist Series

8

**Dowel-Bar Retrofit
for Portland Cement
Concrete Pavements
Checklist**



U.S. Department
of Transportation
**Federal Highway
Administration**

Dowel-Bar Retrofit for Portland Cement Concrete Pavements Checklist

This checklist is one of a series created to guide State and local highway maintenance and inspection staff in the use of innovative pavement preventive maintenance processes. The series is provided through the joint efforts of the Pavement Preservation Program of the Federal Highway Administration (FHWA) and the Foundation for Pavement Preservation (FP²).

FHWA uses its partnerships with FP², the American Association of State Highway and Transportation Officials, and State and local transportation agencies to promote pavement preservation.

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www.fhwa.dot.gov/preservation

www.fhwa.dot.gov/infrastructure/asstmgmt/resource.htm

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Preliminary Responsibilities

Document Review

- Bid/project specifications and design
- Special provisions
- Agency application requirements
- Traffic control plan
- Manufacturers' installation instructions for patch materials
- Material safety data sheets

Project Review

- Verify that pavement conditions have not significantly changed since the project was designed.
- Verify that the pavement is structurally sound. Evidence of pumping (i.e., surface staining or isolated wetness) and faulting exceeding 3 mm (1/8 in.) are indicators of lack of proper subgrade support possibly necessitating undersealing. (See *Concrete Pavement Rehabilitation: Guide for Load Transfer Restoration* [FHWA-SA-97-103].)
- Check estimated quantities for dowel-bar retrofit.

Materials Checks

- ❑ Verify that dowel slot cementing grout meets specification requirements.
- ❑ Verify that dowel slot cementing grout is being obtained from an approved source or listed on the agency Qualified Products List, as required by the specification.
- ❑ Verify that the component materials for the dowel slot cementing grout have been sampled, tested, and approved prior to installation as required by contract documents.
- ❑ Verify that additional or extender aggregates have been properly produced, with acceptable quality.
- ❑ Verify that material packaging is not damaged so as to prevent proper use (packages leaking, torn, or pierced).
- ❑ Verify that caulking filler meets specification requirements.
- ❑ Verify that dowels, dowel bar chairs, and endcaps meet specification requirements.
- ❑ Verify that dowel bars are properly coated with epoxy (or other approved material) and free of any minor surface damage in accordance with contract documents.
- ❑ Verify that curing compound meets specification requirements.
- ❑ Verify that joint/crack re-former material (compressible insert) meets specification requirements (typically polystyrene foam board, 12 mm [1/2 in.] thick).

- ❑ Verify that joint sealant material meets specification requirements.
- ❑ Verify that all required materials are on hand in sufficient quantities to complete the project.
- ❑ Ensure that all material certifications required by contract documents have been provided to the agency prior to construction.

Equipment Inspections

Slot Cutting Equipment

- ❑ Verify that slot sawing machine is of sufficient weight, horsepower, and configuration to cut the specified number of slots per wheelpath to the depth shown on the plans.
- ❑ Verify that removal jackhammers are limited to a maximum rated weight of 14 kg (30 lb).

Slot Cleaning and Preparation

- ❑ Verify that sand blaster unit is adjusted for correct sand rate and that it is equipped with and using oil and moisture filters/traps.
- ❑ Verify that air compressors have sufficient pressure and volume to adequately remove all dust and debris from slots and meet agency requirements.

Mixing and Testing Equipment

- ❑ For auger-type mixing equipment, ensure that auger flights or paddles are kept free of material buildup, which can cause inefficient mixing operations.

- Ensure that volumetric mixing equipment, such as mobile mixers, is kept in good condition and is calibrated on a regular basis to properly proportion mixes.
- Ensure that material test equipment required by the specifications are all available on site and in proper working condition (typically including slump cone, pressure-type air meter, cylinder molds and lids, rod, mallet, ruler, and 3 m (10 ft) straightedge).

Other Equipment

- Verify that vibrators are the size specified in the contract documents (typically 25 mm [1 in.] in diameter or less) and are operating correctly.
- Verify that the concrete testing technician meets the requirements of the contract document for training/certification.
- Ensure that sufficient storage area is available on the project site specifically designated for the storage of concrete cylinders.

Weather Requirements

- Review manufacturer installation instructions for requirements specific to the backfill material used.
- Air and surface temperature meet agency requirements (typically 40 °F [4 °C] and rising) for concrete placement.
- Neither dowel bar installation nor patching should proceed if rain is imminent.

Traffic Control

- Verify that the signs and devices used match the traffic control plan presented in the contract documents.
- Verify that the setup complies with the *Federal Manual on Uniform Traffic Control Devices* or local agency procedures.
- Verify that flaggers are trained/qualified according to contract documents and agency requirements.
- Verify that unsafe conditions, if any, are reported to a supervisor.*
- Ensure that traffic is not opened to the repaired pavement until the backfill material has attained the specified strength or curing time as required by the contract documents.
- Verify that signs are removed or covered when they are no longer needed.

Project Inspection Responsibilities

Slot Cutting and Removal

- ❑ Verify that all slots are cut parallel to each other and to the centerline of the roadway within the maximum tolerance permitted by the contract documents, typically 6 mm (1/4 in.) per 300 mm (12 in.) of dowel bar length.
- ❑ Verify that the number of slots per wheelpath is in agreement with contract documents (typically three or four).
- ❑ Verify that the cut slot length extends the proper distance each side of the construction joint as required by the contract documents. This is especially important for joints and cracks that are skewed.
- ❑ Verify that concrete fins between the saw cuts are removed using 14 kg (30 lb) maximum weight jackhammers.
- ❑ Verify that the bottoms of slots are smoothed and leveled using lightweight bush hammer.

Slot Cleaning and Preparation

- ❑ Verify that after concrete removal, slots are prepared by sandblasting, ensuring that all saw slurry is removed from the slot.

- ❑ Verify that air blasting is utilized to clean slots. A second air blasting may be required immediately before placement of dowel slot cementing grout if slots are left open for a duration exceeding that permitted in the contract documents.
- ❑ Verify that the existing joint/crack is sealed with approved caulking filler along the bottom and sides of slot to prevent concrete patch material from entering the joint/crack.

Placement of Dowels

- ❑ Verify that plastic endcaps are placed on each end of the dowel bar to account for pavement expansion (see Figure 1) as required by the contract documents.

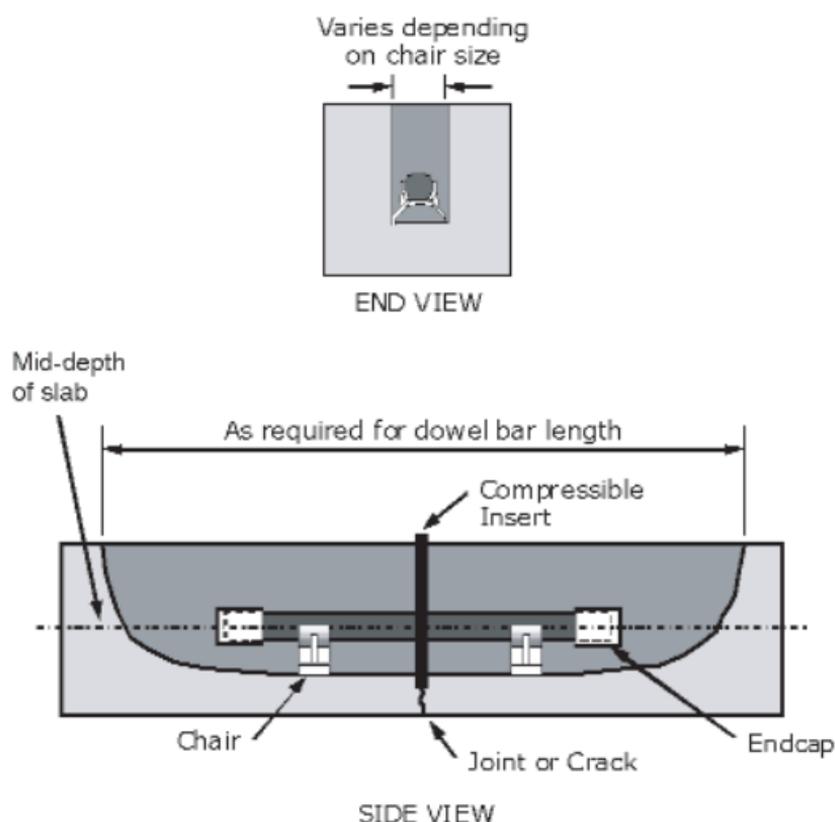


FIGURE 1. Dowel-bar retrofit schematic.

- ❑ Verify that dowels have been coated with lubricant to prevent bonding of concrete patch material to dowels in accordance with contract documents.
- ❑ Verify that proper clearance is maintained between the supported dowel bar and the sidewalls, ends, and bottom of the cut slot in accordance with contract documents.
Schematic diagrams presented in Figure 1 are intended for reference purposes only and are not intended to supersede contract documents.
- ❑ Verify that chairs are used to align the dowel correctly in the slot and support it, and permit dowel slot cementing grout to completely encapsulate the dowel bar.
- ❑ Verify that joint re-former material (foam core insert) is placed at the mid-point of each bar and in line with the joint/crack to allow for expansion and to re-form the joint/crack.
- ❑ Verify that dowels are centered across the joint/crack such that at least 175 mm (7 in.) of the dowel extends on each side in accordance with contract documents.

Mixing, Placing, Finishing, and Curing Backfill Material

- ❑ Verify that quantities of concrete patch material being mixed are small enough to prevent premature set.
- ❑ Verify that material is consolidated using small, hand-held vibrators that do not touch the dowel bar assembly during consolidation.

- Verify that concrete patch material is finished flush with surrounding concrete, using an outward motion to prevent pulling material away from patch boundaries. The surface of the concrete patch material should be finished slightly “humped” if diamond grinding will be done.
- Verify that adequate curing compound is applied immediately following finishing and texturing in accordance with contract documents.

Cleanup

- Remove all concrete pieces and loose debris from the pavement surface.
- Dispose of old concrete in accordance with contract documents.
- Properly clean mixing, placement, and finishing equipment for the next use.

Diamond Grinding

- Diamond grinding of the pavement surface should be completed within 30 days of placement of the concrete patch material.

Resealing Joints and Cracks

- Verify that joints are resealed after diamond grinding in accordance with contract documents.

Common Problems and Solutions

(Problem: Solution)

- ❑ **Sawcuts (sides of slots) are not parallel to each other or the pavement centerline:**
Use a saw slot cutting machine.
- ❑ **Slots are cut too shallow:**
Re-saw the slots and remove concrete to the proper depth.
- ❑ **Slots are cut too deep:**
 1. Use a lighter weight jackhammer, maximum 14 kg (30 lb).
 2. Do not lean on the jackhammer.
 3. Do not orient the jackhammer vertically; use a 45-degree angle and push the tip of the hammer along the bottom of the slot.
 4. Stop chipping when within 50 mm (2 in.) of the bottom of the pavement.
 5. If jackhammers punch through the bottom of the slot, make a full-depth repair across the entire lane width at the joint/crack.
- ❑ **Concrete fin is not easily removed:**
Check for mesh reinforcement, and sever the steel at each end before attempting to remove the fin of concrete.

- ❑ **Dowel cannot be centered over joint/crack because slot does not extend far enough:**
Chip out additional slot length with a jackhammer to facilitate proper placement of steel dowel in accordance with contract documents. Typically at least 175 mm (7 in.) of each 350 mm (14 in.) dowel extend on each side of joints. Properly sized chairs will fit snugly into the slot.
- ❑ **Dowels are misaligned after vibration:**
 1. Do not allow the vibrator to touch the dowel assembly.
 2. Check for over-vibration; each slot should require only two to four short, vertical penetrations of a small-diameter spud vibrator.
 3. Ensure that the slots are sized the exact width of the plastic dowel bar chairs.

Sources

Information in this checklist is based on or refers to the following sources:

- ❑ *Concrete Pavement Rehabilitation: Guide for Load Transfer Restoration*. ACPA JP001P / FHWA-SA-97-103. 1997. Washington, DC: Federal Highway Administration. Available at www.pavement.com.
- ❑ *Load Transfer Restoration: Diamond Saw Slot Cutting vs. Carbide Milling*. SR905P. 2001. Skokie, IL: American Concrete Pavement Association. Available at www.pavement.com.
- ❑ *Manual on Uniform Traffic Control Devices*. 2003. Washington, DC: Federal Highway Administration. Available free at <http://mutcd.fhwa.dot.gov>.
- ❑ *Rapid Setting Patch Materials for Portland Cement Concrete*. National Transportation Product Evaluation Program. 2002. Washington, DC: American Association of State Highway and Transportation Officials.
- ❑ *Specification Guideline for Dowel Bar Retrofit (IS104P)*. 2002. Skokie, IL: American Concrete Pavement Association. Available at www.pavement.com.

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